

CLAIMS

1. A capacitor comprising:

5 a capacitor element including a pair of electrodes in a polarized electrode layer formed on a current collecting unit made of metal foil, and the pair of electrodes being shifted in opposite directions from each other with a separator intervening between the pair of electrodes, and the pair of electrodes together with the separator being rolled to form the capacitor element;

10 a cylindrical metal housing with a bottom for accommodating the capacitor element and driving electrolyte; and

a terminal plate for sealing an opening of the metal housing, wherein the terminal plate has a terminal slip insert-formed of insulating resin, the terminal slip including a terminal for outer connection and a rib to be coupled to a first electrode of the electrodes oriented in opposite
15 directions,

wherein the first electrode is coupled to the rib of the terminal slip, and a second electrode is coupled to an inner bottom face of the metal housing, so that one of an anode and a cathode is brought out through the terminal of the terminal slip for outer connection and remaining one of the anode and the
20 cathode is brought out through the metal housing.

2. The capacitor of claim 1, wherein a rib protruding in part is provided to a joint face between the inner bottom face of the metal housing and the capacitor element.

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3. The capacitor of claim 1, wherein brazing is provided to at least one of a joint section between the rib of the terminal slip and the capacitor element

or a joint section between the inner bottom face of the metal housing and the capacitor element.

4. The capacitor of claim 1, wherein at least one of a joint section
5 between the rib of the terminal slip and the capacitor element or a joint section between the inner bottom face of the metal housing and the capacitor element takes a form of clad structure which is formed of aluminum solder formed on a substrate.

10 5. The capacitor of claim 1, wherein a safety-valve mounting hole, which also functions as an electrolyte inlet, is provided to the terminal plate.

6. The capacitor of claim 1 includes a capacitor element which has a polarized electrode layer, which structures electrodes, formed on a current
15 collecting unit leaving the current collecting unit in part exposed on one end of the current collecting unit, wherein a pair of the electrodes in the polarized electrode layer are arranged such that the exposed section of the current collecting unit is oriented in opposite directions to each other, and a separator intervenes between the pair of the electrodes, and the pair of the electrodes
20 together with the separator are rolled for forming the capacitor element.

7. The separator of claim 1 includes a capacitor element which has a polarized electrode layer, which structures electrodes, formed overall a current collecting unit, wherein a pair of the electrodes in the polarized electrode layer
25 protrude their ends in opposite directions respectively, and a separator intervenes between the pair of the electrodes, and the pair of electrodes together with the separator are rolled for forming the capacitor element.

8. The capacitor of claim 1, wherein insulation is provided to the metal housing at a section contacting a sealing rubber disposed on a rim of a top face of the terminal plate.

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9. The capacitor of claim 1, wherein a first capacitor is brought out its anode in the electrodes oriented in opposite directions through the terminal provided to the terminal plate for outer connection and its cathode is brought out through the metal housing, and a second capacitor is brought out its cathode through the terminal provided to the terminal plate for outer connection and its anode is brought out through the metal housing, wherein the metal housings of the first and the second capacitors are coupled together for connecting the first and the second capacitors in series.

10. The capacitor of claim 9, wherein the first capacitor and the second capacitor are coupled together in series to form one unit, and a plurality of the units are coupled together in series.

11. A method of manufacturing the capacitor as defined in any one of claims 1 through 8, wherein both of end faces of the capacitor element is heated at not lower than 180°C, then the polarized electrode layers formed on both the end faces of the capacitor element are removed mechanically.

12. A method of manufacturing the capacitor as defined in any one of claims 1 through 8, wherein the polarized electrode layer is removed mechanically from at least one of both end faces of the capacitor element whichever the end faces contacts at least one of the terminal plate and the

metal housing.

13. A capacitor comprising:

5 a capacitor element including a pair of an anode and a cathode in an polarized electrode layer formed on a current collecting unit made of metal foil, a separator intervening between the anode and the cathode, wherein the anode and the cathode are rolled together with the separator, so that the capacitor element is formed such that it includes a hollow section and the anode and the cathode are oriented in opposite directions;

10 a cylindrical metal housing with a bottom enclosing the capacitor element and driving electrolyte, wherein a first electrode of the capacitor element is coupled to an inner face of the bottom; and

a terminal plate, of which inner face is coupled to a second electrode of the capacitor element, for sealing an opening of the metal housing,

15 wherein the inner face, to which the second electrode of the capacitor element is coupled, of the terminal plate is referred to as a reference plane, and the reference plane is protruded toward a surface side leaving a plurality of belt-like coupling sections which lie from a rim toward a center of the terminal plate as they are, and the terminal plate has a protrusion to be
20 fitted into the hollow section of the capacitor element, and the terminal plate also has a terminal at a center of its surface for outer connection, so that the first electrode of the capacitor element is brought out through the metal housing and the second electrode is brought out through the terminal of the terminal plate.

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14. The capacitor of claim 13, wherein the terminal provided at the center of the surface of the terminal plate for outer connection comprises an

internal thread.

15. The capacitor of claim 13, wherein the terminal plate has a step at a rim of the surface for firmly receiving a sealing rubber.

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16. The capacitor of claim 15, wherein the terminal plate has an annular step at the rim of the surface, and the step includes an annular protrusion generally at its center.

10 17. The capacitor of claim 13, wherein the terminal plate has a rotation stopper formed of at least one of a dint and a protrusion on the surface.

18. The capacitor of claim 13, wherein the terminal plate includes a safety-valve mounting hole which also functions as an inlet for the driving
15 electrolyte, and a recess which receives in a non-contact manner a safety valve, which is to be fitted to the safety-valve mounting hole, is provided to the electrodes of the capacitor element.

19. The capacitor of claim 13, wherein the terminal plate includes
20 unitarily an annular rising section at a rim of the surface and a winding processing section extending like a brim along diameter direction from an upper end of the rising section, and the winding processing section and the opening of the metal housing are wound together for sealing, and the metal housing includes a terminal for outer connection on its outer bottom face.

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20. The capacitor of claim 13, wherein a tip of the terminal for outer connection provided at the center of the surface of the terminal plate is tapered

to form a coupling section to be caulked.

21. The capacitor of claim 13 or claim 19 includes a capacitor element which has a polarized electrode layer, which structures electrodes, formed on a current collecting unit leaving the current collecting unit in part exposed on one end of the current collecting unit, wherein a pair of the anode and the cathode in the polarized electrode layer are arranged such that the exposed section of the current collecting unit is oriented in opposite directions to each other, and a separator intervenes between the pair of electrodes, and the pair of electrodes together with the separator are rolled for forming the capacitor element.

22. The separator of claim 13 or claim 19 includes a capacitor element which has a polarized electrode layer, which structures electrodes, formed overall a current collecting unit, wherein a pair of the anode and the cathode in the polarized electrode layer are shifted in opposite directions from each other and protrude their ends respectively in opposite directions, and a separator intervenes between the pair of electrodes, and the pair of electrodes together with the separator are rolled for forming the capacitor element.

23. A capacitor comprising:

a capacitor element including a pair of an anode and a cathode in an polarized electrode layer formed on a current collecting unit made of metal foil, a separator intervening between the anode and the cathode, wherein the anode and the cathode are rolled together with the separator for forming the capacitor element, and the anode and the cathode are oriented in opposite directions;

a cylindrical metal housing with a bottom enclosing the

capacitor element and driving electrolyte, wherein a first electrode of the electrodes oriented in opposite directions of the capacitor element is coupled to an inner face of the bottom, and the metal housing has an annular section having undergone a drawing process, which results in a V-shaped sectional view
5 so that the processed section can hold down a rim of an end face of a second electrode of the electrodes from outside;

a terminal plate, of which inner face is coupled to the second electrode of the electrodes oriented in opposite directions of the capacitor element, for sealing an opening of the metal housing;

10 a first insulating ring formed on an upper end of the processed section of the metal housing such that the ring lies between an outer wall of the terminal plate and an inner wall of the metal housing and continues to inner face in part of the terminal plate; and

a sealing ring made of rubber disposed on the rim of the surface
15 of the terminal plate, and an end of the opening of the metal housing is curled so that the sealing ring can seal the opening,

wherein a ring-shaped insulating sheet is placed from a rim of an end face of the capacitor element at the terminal plate side to an outer wall in part continued from the end face of the capacitor element, or the metal housing
20 is insulated at least its inner wall in part which closely faces to the capacitor element at the rim of the end face and the outer wall in part continued from the rim of the terminal plate.

24. The capacitor of claim 23, wherein a second insulating ring is
25 disposed between the first insulating ring and an end face of the capacitor element in place of the ring-shaped insulating sheet placed from a rim of an end face of the capacitor element at the terminal plate side to an outer wall in part

continued from the end face of the capacitor element or the insulation at least at the inner wall of the metal housing in part which closely faces to the capacitor element at the rim of the end face and the outer wall of the capacitor element in part continued from the rim.

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25. The capacitor of claim 24, wherein the metal housing has an annular section having undergone a drawing process which results in a V-shaped or U-shaped sectional view, and at least one of a lateral face and a bottom face of the processed section contacts the second insulating ring.

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26. The capacitor of claim 25, wherein the first insulating ring and the sealing ring are replaced with a sealing ring which is formed to contact in part of the outer wall and respective rims of surface and underside of the terminal plate.

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27. The capacitor as defined in any one of claims 23 – 26, wherein at least one of the first and the second insulating rings is made of rubber.

28. The capacitor as defined in any one of claims 23 – 26, wherein at least one of the first and the second insulating rings is made of resin, and the resin has a bending modulus not less than 500Mpa.

29. The capacitor as defined in any one of claims 23 – 26 includes a capacitor element which has a polarized electrode layer, which structures electrodes, formed on a current collecting unit leaving the current collecting unit in part exposed on one end of the current collecting unit, wherein a pair of the anode and the cathode in the polarized electrode layer are arranged such

that the exposed section of the current collecting unit is oriented in opposite directions to each other, and a separator intervenes between the pair of electrodes, and the pair of electrodes together with the separator are rolled for forming the capacitor element.

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30. The separator as defined in any one of claims 23 – 26 includes a capacitor element which has a polarized electrode layer, which structures electrodes, formed overall a current collecting unit, wherein a pair of the anode and the cathode in the polarized electrode layer protrude their ends in opposite directions respectively, and a separator intervenes between the pair of electrodes, and the pair of electrodes together with the separator are rolled for forming the capacitor element.

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31. A capacitor comprising:

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a capacitor element including a pair of an anode and a cathode in an polarized electrode layer formed on a current collecting unit made of metal foil, a separator intervening between the anode and the cathode, wherein the anode and the cathode are rolled together with the separator to form the capacitor element, and the anode and the cathode are oriented in opposite directions;

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a cylindrical metal housing with a bottom enclosing the capacitor element and driving electrolyte, wherein a first electrode of the electrodes oriented in opposite directions of the capacitor element is coupled to an inner face of the bottom; and

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a terminal plate, of which inner face is coupled to a second electrode of the electrodes oriented in opposite directions of the capacitor element, for sealing an opening of the metal housing,

wherein the first electrode of the capacitor element is brought out through the metal housing, and the second electrode is brought out through the terminal provided to the terminal plate,

5 wherein two of the capacitors are coupled electrically and mechanically together with different polarities from each other into one unit by a coupling plate.

32. The capacitor of claim 31, wherein the coupling plate shapes in hexagon and is disposed to the bottoms of the metal housings of the two capacitors for coupling the two capacitors by laser welding.
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33. The capacitor of claim 32, wherein a contacting area between the coupling plate and the bottoms of the metal housings is less than 50% of a total bottom area of the metal housings.
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34. The capacitor of claim 32, wherein traces by welding between the coupling plate and the metal housings form a straight line.

35. The capacitor of claim 32, wherein the coupling plate has a notch getting around a border between the two capacitors to be coupled by the coupling plate.
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36. The capacitor of claim 31, wherein the two capacitors are sheathed into one unit with a heat shrinkable film made of resin.
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37. The capacitor of claim 31 includes a capacitor element which has a polarized electrode layer, which structures electrodes, formed on a current

collecting unit leaving the current collecting unit in part exposed on one end of the current collecting unit, wherein a pair of the anode and the cathode in the polarized electrode layer are arranged such that the exposed section of the current collecting unit is oriented in opposite directions to each other, and a
5 separator intervenes between the pair of electrodes, and the pair of electrodes together with the separator are rolled for forming the capacitor element.

38. The separator of claim 31 includes a capacitor element which has a polarized electrode layer, which structures electrodes, formed overall a current
10 collecting unit, wherein a pair of the anode and the cathode in the polarized electrode layer are shifted in opposite directions from each other, and respective ends of the pair protrude in opposite directions, and a separator intervenes between the pair of electrodes, and the pair of electrodes together with the separator are rolled for forming the capacitor element.